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ABSTRACT

To illustrate the capabilities of local area networking (LAN) and integrated software programs, this paper reviews current software programs relevant to writing instruction. It is argued that the technology exists for students sitting at one microcomputer to be able to effectively carry out all phases of the writing process from gathering online data to collaborating with teacher and peers through computer message systems. The paper explains the differences between LAN and multiuser systems, emphasizes that ordinary software stored on disks will not work in an LAN, and discusses the problem of incompatible computers (e.g., an Apple computer cannot talk to an IBM computer). Finally, the paper describes current LAN product choices and choices for Apple computer owners, and lists manufacturers of LANs. (SRT)

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Networking Microcomputers in the Writing Center: Alternative Pedagogical Applications to Using Stand Alones

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Although the earliest microcomputer programs--because of memory limitations--worked alone, the movement currently is in the direction of creating programs that work together. For example, in addition to drills that teach spelling in isolation, there are now spelling-checker programs designed to run on specific word-processing programs that point out words in the writer's text that may be misspelled. There are also style checkers intended to point out features in the writer's use of language. Additionally, writing programs designed in integrated packages are attempting to provide the writer with increased options during the writing process. Appleworks, a multiple program package, is one example. It consists of three programs--word processing, spread sheet, and data base management--that permit information to be passed back and forth from one program to the other.

In academic environments where mainframe or minicomputers are connected to terminals, integrated software that is directed at many of the aspects of the writing process, but that necessitate large computer memories, is being developed in schools such as Carnegie Mellon. But until very recently such integrated writing packages because of their large memory requirements have been beyond the

imaginations of writing centers and classrooms using microcomputers.

However, the telecommunications possibilities currently being developed for microcomputers, for example local and wide-area networking, are now expanding the options for interactve software and communications in microcomputer writing environments. It seems safe to assume that program design, especially in tandem with technological advances, will result in the continued development of new computer applications for writing and writing instruction. Future directions are likely to continue creating more integrated programs, especially given the larger memories and greater potential for sharing that local area networks and hard disk storage make possible.

It will probably not be too long before students working at microcomputers in their classrooms--even in more distant locations--will be capable of effectively carrying out all phases of the writing process. Students sitting at microcomputers could gather data for a term paper, for example, from the electronic data bases of an online library, take and file notes systematically from their electronic sources, and collaborate with their classmates and teacher about their paper's topic or focus by "talking" back and forth on their computers. The student could also use pre-writing or invention programs to brainstorm ideas, to freewrite, and, if appropriate, to develop a working outline. Using the power of word processing the student would then be able to flesh out a rough draft, receiving comments from fellow students and the teacher who had read the draft online. The student could then revise the paper in the light of these suggestions and edit it for spelling or style

based on the information provided by editing programs as well as the class members. Finally, the student could send the finished draft via electronic mail to the teacher with copies to classmates.

Far from being a futuristic fantasy, such a scenario is possible today, at least to the extent that the technological sophistication to create such an environment exists. However, the reality is that for the most part the software programs that exist currently, with a few exceptions, work by themselves in isolation from other programs. The software still needs to be developed that will support this vision of writing on microcomputers. Currently, most software is a potpourri written by many different people for many different purposes. It is mostly not designed to be part of a larger integrated electronic writing environment.

Like the baby who babbles to explore language before speaking, we are still in the babbling phase of this new medium. The constraints involved in developing sophisticated electronic writing environments are still formidable and the current cost factors both for development and implementation, especially given the uncertainty of the educational marketplace, is without a doubt the biggest hurdle. Such a vision of writing requires that microcomputers in schools be connected into local area networks (LAN's) so that information may be passed between computers. It requires that students have access to wide-area networks in order to gather electronic information from more distant sources such as online libraries. Networking microcomputers has been an expensive proposition and until recently hardware companies were not particularly concerned with designing networks to meet the needs of educational settings. Lacking school communities with networking

capabilities, software developers could not create appropriate software.

Yet since integrated applications are possible, it seems likely that one day, probably in the not too distant future, writing classrooms with these features--as well as others more exotic than I dare to imagine--will become a reality. In fact, under these circumstances the classroom itself could easily become an anachronism, since students and teachers would not need to be physically present in the same room.

How close can we now come to an electronic writing classroom where students communicate freely back and forth between computers networked together? We are close. But, perhaps because we are so close, the state of the technology is a rather tangled and complex matter. The rest of this paper attempts to sift through the maze of existing information concerning the technological aspects of networking in order to clarify some of the significant areas we need to be aware of before spending large sums of money to create local area networks in our schools.

Definition

Computer networking is a collection and connection of terminals. Theoretically, any network-connected microcomputer can serve many functions: a remote, on-line workstation; an "off-line" stand-alone workstation; a mass storage unit (if it is equipped with a mass storage device); or even, on some network designs, the network controlling device, known as the file server. In actuality, most networks are equipped with a file server unit in a separate and distinct cabinet that looks like a mini-refidgerator and functions

as a traffic controller, storage space allocator and is the machine that lets terminals access data from storage.

Usually, any or all microcomputers on a network can access data via the file server(s) from the on-line memory storage device. Some networks allow computers to access data from other computers on the network via electronic mail or other kinds of common data access software programs. The technology exists for a local area network (LAN) to provide access by one computer to all others on the network without disturbing their ongoing functions. The key element of LAN's is the capability of allowing any computer connected to the network to access all other units on the line, whether they are other computers, mass memory storage devices, or printers. Note that current LAN products do not yet allow microcomputers to talk directly to one another. It is important to note that LAN's are a new technology in the microcomputer environment and not all manufacturers offer systems that do everything that one wants nor that is technologically feasible.

Be aware that microcomputer LAN's do not offer direct communication links between on-line units, partly because it is not yet thought to be an essential component, and partly because adding that feature would drive up the price of the LAN, making it less competitive. Current direct communication ties between microcomputers can be accomplished via telephone lines and communicaton hardware (modems) and software.

An important distinction must be made also between local area networking and multiuser systems . Multiuser systems, sometimes known as "cluster systems," involve connecting "dumb" terminals to a mass memory storage facility and to one or more

printers. Local area networks, on the other hand, connect intelligent full-capacity computers to storage devices and peripherals.

The key factor in determining if you have an LAN or a cluster system is whether or not the units connected to the LAN are computers (have their on intelligence). In the multiuser or cluster system, terminals do not store data but send and receive it from a mass storage hard (as opposed to floppy) disk. Data stored by one computer on the hard disk may be accessed by any other or all, which is as close to sharing as this system design can manage. The major difference, then, between computers on a LAN and clustered terminals is the resident intelligence in the computers and the lack of same in the "dumb" terminals.

Aside from the intelligence of the machines, the file server is the missing technological link in the cluster system, and the single element that makes the local area network superior in design for most educational applications. Here is also where the distinction between these systems is murky. Manufacturers will call any kind of system that connects terminals a LAN. For example, Wang Laboratories Inc. sells a product called WangNet that connects Wang data and/or word-processing terminals and which it calls a local area network. While it has a central processing unit where all computer intelligence, programs, and data are stored, WangNet did not originally tie in intelligent computers that could work on or off the system, nor did it allow for any exchange of data between terminals. The product has been updated now to do both and can be considered a true local area network for Wang machines.

The file server on a LAN is an electronic information

traffic flow controlling device, allowing information "bit streams" to be passed around the network so that it does not collide with any other bit stream and allows it to arrive at a pre-arranged destination in the same form as it began the journey. Thus the file server directs the flow and preserves the integrity of information as it moves along the network from its machine of origination to a printer or an on-line storage device.

The Software Issue

It is important to note that ordinary standalone microcomputer software (usually stored on floppy disks) will not run on a local area network. There must be some reprogramming for it to run on the network and if it is copy protected the manufacturer must grant permission and the necessary information to the programmer to remove the protection. Software manufacturers usually grant permission for their products to run as networking software at a cost greater than--often three times as much--the single computer version. It has been a case of good news, bad news: hardware costs have dramatically declined while software pricing has steadiy climbed higher and higher. But the good news in the bad is that software development will soon be more profitable, stimulating growth in a greater quantity of quality software products. Steven Jobs, legendary co-founder of Apple Computers Inc., has said the LAN for microcomputers was a "chicken-egg situation: not enough interest in networking meant less software was being created for LAN's, and no LAN software meant less demand for LAN hardware.

Finally, there are very few computer standards in effect today, and different computer manufacturers produce very different

microprocessors and operating systems that are seldom compatible with one another. (The IBM PC look-alikes are the exception.) For example, an IBM PC will not "talk" directly to an Apple computer, and unless there is a difficult and complex code conversion program written especially for the particular incompatible computers, a LAN alone will not solve the technological problem, though many LAN's on the market today do offer compatibility between certain popular makes. In other words, without the necessary conversion programming, you can electronically ship a memo to me in bit streams over a LAN from your Apple to my IBM PC, but on my computer's monitor the memo will look like Cincinatti at night from 39,000 feet.

Current LAN Product Choices:

Briefly, there are three forms a LAN can be wrapped in: bus, star, and ring. Though there are advantages and disadvantages to all three, the non-technical person need not be overly concerned with this area, and most computer industry watchers agree that vendors simply have made a technological choice to go with a particular design. Any one can be as good as another, and at least one major management consultant, Arthur E. Lemay, president of his own firm, believes that the computer industry press has made far too much of these design differences. However, designs can limit the physical arrangment of microcomputers in a classroom, the distance microcomputers can be from the cables, the number of micromputers that can be run efficiently on the LAN, and the overall distance of cabling permissable on the LAN. Therefore, the educational purchaser of a LAN needs to inquire carefully about these matters

relative to his/her particular LAN needs before deciding on one system over another.

Apple Computers Inc. has delivered a LAN for the Macintosh that now will handle the Apple II family of computers designed around what is called the bus architecture (see diagram A) that is inexpensive, running about $50 per hook-up. The star design is less common (diagram B) but easily as efficient as the bus. Finally, the ring design (diagram C), sometimes called token-ring, was the first and is about as widely used as the bus. With all the vendors there is a tendency to claim that their particular technological choice is the best, and clearly each does some things better than the others. However, the various claims, especially in combination with the fact that companies do not want to highlight the shortcomings of their LAN, makes it extremely difficult for even the alert and computer literate consummer to find out the information essential to making an informed choice.

It's important to understand the numbers of computers that may be attached to the LAN, the distance they may be from one another, and how printers, file servers attach, and which hard disks with what storage capacities operate with any particular LAN. Other appropriate questions include which vendor's computers are served, whether or not machines talk directly to one another, and access speed (many systems will slow down considerably when every unit connected is in operation).

Choices for Apple Computer Owners

Since Apple is the leader in educational computing, we'll begin with it in describing the few LAN products available. The LAN

choices for Apple computers include Apple's own AppleTalk, a bus network currently designed for Macintosh computers in a business setting. But AppleTalk will have an Apple IIe adapter card no later than mid-1986 (possibly much sooner), which might mean that low-cost networking ($50 per connected device) could be available to schools that have IIe's. (It should be noted, however, that AppleTalk initially only permitted the sharing of peripherals such as printers and that one reason for the low price of it for the Macintosh was that some of the technology was hardwired into the Macintosh itself.) There was, toward the end of 1985, talk at Apple of bringing out an AppleTalk file server, but the company would not confirm nor deny that rumor.

Currently, however, a little known company, Centram Systems West, offers its TOPS network that is totally compatible with AppleTalk protocols and cabling, and it has a design that turns any computer on the network into both a file server and a computer workstation, as long as the computer is equipped with a hard disk.

TOPS lets a IIe with a hard disk, a Macintosh with what is called Hyperdrive, or an IBM PC/AT (or all three) operate as the network file server. TOPS also supports the IBM PC and compatibles, and a variety of operating systems, including CP/M 80 and UNIX. Cost is approximately $100 to $300 per connection, depending on which computer is being networked, and it works in conjuntion with AppleTalk hardware and, with the IIe, an adapter card.

A note of caution: Centram skirts around the software issue, explaining that it can support standard software exchanges such as the Lotus 1-2-3 package. While it may well allow Apple software to run on the system, it would be best to try everything

you must run on a working TOPS/AppleTalk network before purchase. As a rule, the LAN hype exists everywhere, and the wise consumer will run systems and software (not merely see it run) before signing anything.

One of the most popular LAN's for Apple products is Omninet, a Corvus Systems product. It runs via standard twisted-pair cable similar to telephone wire and is a bus network that literally snaps together as easily as a stereo system, according to the manufacturer. The vendor also claims that Omninet can support about 60 computers and four additional peripherals, although the average network size is from 12 to 15 units in an educational environment, according to the manufacturer. (Generally, the more units you connect to any LAN the lower everything operates, and a thorough test for speed of the network running the number of units you want to connect is an absolute must.) Omninet is designed for the Apple II, IBM PC, Digital Equipment Corp. Rainbow, and others, including Texas International and Zenith.

Corvus implants its file server operation within its mass storage hard disk drive, called OmniDrive, rather than using a separate unit, and Corvus LAN's do not talk directly to one another.

OmniDrive stores data as well as manages user instructions for traffic, retrieval, loads annd saves information and programs. OmniDrive is the mass storage hard disk product that offers some 126,000 bytes of storage. Eight such units can be connected to an Omninet network, for a total of one-billion bytes, or a storage capacity of about half-a-million pages of text. The Omninet printer server is required of this LAN for getting hard copy. It handles

print requests from as many as three printers and costs just under $1,000. Corvus sells a smaller and cheaper 11-megabyte version of its Omnidrive for just under $2,000, which is a good "starter-kit" size. Corvus also sells a back-up data storage unit for $2,195.

Corvus has excellent educational discounts of up to 33 percent that are available for orders in excess of $50,000; a standard 25 percent discount is available for orders over $1,000. A gigantic plus for Corvus is that it already has about 800 network-compatible software products.

Other Apple-compatible LAN's include those manufactured by Sunol Systems and a manufacturer that has the distinction of being the makers of the most expensive LAN available. The Nestar Systems file server can run to about $24,000, but it is equipped with features that include communicating with the school's mainframe computer.

Schools that use IBM PC's will find no inexpensive LAN pathway, including IBM's own system, called PC Network. But a superior product to the PC Network, according to some industry watchers, and one costing about $600 per connection, is offered by Novell Inc.

Its product, NetWare S-Net, uses the star design with as many as 24 computers tied directly to the file server. It supports the IBM PC, XT, AT, Texas Instruments Professional and Victor 9000 workstations. Each server can accommodate five printers and up to 500,000 bytes of storage.

NetWare's ARCNET token-ring LAN connects up to 50 computers per server and can communicate with an IBM mainframe. Novell also provides necessary LAN software for Corvus' Omninet LAN for IBM

micros.

Variety, a wide range of functions and cost seem to be the norm in LAN's today. As the computer industry sorts out its options and continues to develop better products, it continues to listen more closely to the business community than to educators for advice regarding technological development directions. Perhaps it's time now for educators to be more aggressive and vocal in spelling out their computer networking requirements.

Manufacturers:

Centram Systems West
Berkeley, CA (415) 664-8244

Corvus Systems
San Jose, CA (415) 559-7000

Sunol Systems
Pleasanton, CA (415) 484-3322

Nestar Systems
Palo Alto, CA (415) 493-2223

Novell Inc.
Orem, Utah(801) 226-8202